

REMARKS

In this preliminary Amendment, Applicant amended Claims 1 – 3 and added new Claim 4. Claims 1 – 3 have been amended to rephrase certain expression. Claim 4 has been added to specify various embodiments of the present invention. The support for the amendment can be found throughout the specification. The specification has been amended to rephrase certain expression and correct certain clerical errors. It is respectfully submitted that no new matter has been introduced by the amended claims and specification. All claims are now present for examination and prompt action toward that end is respectfully solicited.

Respectfully submitted,

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Marked-up Version of Specification Showing Changes Made

TRACTIVE LINEAR RECIPROCATING PROPULSION APPARATUS

5 TECHNICAL FIELDBACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

10 [0001] The present invention relates to a driving apparatus and, in particular, to a
driving apparatus that is characterized by a single endless chain and manually
powered linear propulsion, mainly used for ~~securely sustained~~ non-motorized vehicles
or vessels with stable support.

~~BACKGROUND OF THE INVENTION~~DESCRIPTION OF PRIOR ART

15 [0002] Vehicles and vessels need ~~power driving~~ to be driven by power. Manually
powered devices are commonly used in non-motorized wheel vehicles, among which
some have linear reciprocating driving ~~mechanics~~ mechanisms for the purpose of
substituting for walking rather than entertaining or exercising. Their structures are
20 complex. Few can be put into actual use.

[0003] Chinese Pat. No. 99108216.8 (CN1275511A) ~~forwarded~~ discloses a bicycle
with linear movement of pedaling. It has a toothed rack driving mechanism affixed on
a tilted square frame. There are ~~with~~ two toothed racks in a sliding groove.
Depression of either pedal will cause the racks to move, thus draw sprocket wheels
25 and a chain, and transfer the power to a rear driving wheel. A reset gear is used for
reset control.

[0004] Other ~~related~~ Related patents are US,A,6129646 (Farmos),; US,A,5236211
(Meguerditchian),; Fr,A,2544052(MICHAUDETG),; US,A,4169609 (Zsmpedro),;
and US,A,3891235 (Shelly). All the above-mentioned references disclose open
30 technical designs that employ double a plurality of ~~endless chain mechanisms for~~
alternate propelling-in turn. The operating process is simple. However it needs two
sets of components to work ~~working~~ alternately. The structure is ~~much~~ very

complicated and there are some difficulties in processing and installation.

5 [0005] Chinese Pat. No. 99123093.0 (CN1298824A) ~~forwarded-discloses~~ a bicycle with a rocking ~~rotatable~~ crank. Its driving mechanism adopts two prime cranks on the left and right for pedal driving. The rear end of the crank is connected with the ~~crank~~ shaft end of a rear wheel with a driven crank linked ~~ing-in~~ between, to drive a small sprocket and form a secondary transmission together with a coaxial large sprocket. Finally, ~~and finally~~ the driving power is transmitted to the driving shaft of the rear wheel. ~~It also belongs to approximately~~ Its method of operation approximates the linear movement of pedaling. ~~But~~ but with too many transmission links, its efficiency is unavoidably ~~reduceds~~ and reduced efficiency.

15 [0006] ~~My~~ Chinese Patent Application (Application No. 01132621.2) discloses “a tractive chain-gripping cycle ~~bicycle~~” including the structure of a steel wire rope traction. However, the steel wire rope will curl in the course of ~~small pulley~~ transmitting torque via a small pulley and the curl will affect normal operation of the cycle. In addition, the ~~mechanics-mechanism~~ sometimes fails in reversing.

[0007] Obviously, the ~~mechanics-mechanism~~ of the linear pedaling type shall first ensure its smooth and continuous running operation, as well as the convenience ~~of~~ processing during manufacture, especially avoiding ~~overmany excessive~~ transmission links and ~~reducing-reduce~~ idle runs so as to improve transmission efficiency.

20

DISCLOSURE SUMMARY OF THE INVENTION

25 [0008] The present invention ~~refers-relates~~ to a tractive linear driving apparatus with good integration and structure quality which ~~is applicable to equipping with~~ can be conveniently equipped on manually-powered carriers. The apparatus ~~features~~ has considerable flexibility in the ~~design-manner~~ of applying force, greater scope for development and design, and comparatively higher transmission efficiency.

[0009] The present invention of tractive linear reciprocating driving apparatus consists of a solid (main) frame as a fixed member; ~~a movable member having a slipping module~~ a sliding assembly incorporating ~~an engaging~~ a chain-gripping and reversing ~~mechanics-mechanism~~ as a movable member; and ~~transmission members of~~

a single endless chain, and its sprocket wheel and flywheel as a transmission member. The shaft of a flywheel outputs power and forms-achieves mechanical transmission.

[0010] This tractive linear reciprocating driving apparatus comprises-slipping module a sliding assembly, a slave engaging-chain-gripping and reversing mechanicsmechanism, a flywheel, a driven sprocket, a chain and a main guide column, it has said apparatus comprising:

[0011] A-a main frame that consists of a guide column, an auxiliary frame column and main frame endplates, the two ends of the frame are affixed with the flywheel and the driven sprocket with a single endless chain installed and linked in between. Its, its-guide column and auxiliary frame column used for directional linear sliding are installed on the side of the plane formed by the endless chain. -ring plane; a-slipping module A sliding assembly for linear driving and a slave engaging-chain-gripping and reversing mechanics is-mechanism are installed on the guide column;. The the upper and lower slide bars of the slipping-module-sliding assembly are mounted on the guide column for slide-sliding upwards and downwards along the guide column;. The pedals and handpowered rods are used to apply force to butt-fixed to plates on both sides of-slipping-module the sliding assembly for driving forces to apply thereon;

[0012] It-The apparatus is characterized by:

[0013] 1) The said-the slave chain-gripping slave engaging-and reversing mechanics mechanism has an-engagement means-a chain-gripping box located in the plane of the chain ring; the upper and lower slave slide bars connected with the said-engagement means is-chain-gripping box are mounted on the guide column;. engaging-toothed bar A chain-gripping tooth plate is provided in the-engagement means chain-gripping box;. One end of the chain-gripping tooth plate that is subject to force is float-connected to the sliding assembly via a connector. The connector consists of a pull-up rod, a pull-down rod and a connecting rod. -strained end is float connected with-slipping module and connecting pieces that consist of pull-up rod, pull-down rod and connecting rod; the-toothed The tooth plate bar-in said engagement means chain-gripping box has two chain-gripping teeth to engage said chain on both directions working-to work jointly with both chain-retaining boards, and-chain-and

~~activating alternately with teeth in each direction~~ to engage the chain alternatively.

[0014] 2) A ~~a~~ reversing compensation means is ~~designed~~ provided for the slave chain-gripping ~~engaging and reversing mechanics-mechanism~~ to reverse, the reversing compensation means ~~that comprises~~ comprising a resilient member contacting the front of ~~chain-the~~ the tooth of the driven sprocket directly or indirectly in opposite direction, and reserving a space or clearance ~~is left~~ for movement.

[0015] The ~~said~~ reversing compensation means is a mobile ~~mechanics-mechanism~~ for the purpose of elastic contact located on or beneath the slave sprocket. ~~An~~ and its arm of the reversing compensation means is in contact with ~~may contact~~ the front surface of ~~chain-the~~ the tooth of slave-the driven sprocket elastically under the action of its ~~said~~ resilient member. ~~To check chain tooth stop or prevent the reversing movement of the chain tooth of the driven sprocket,~~ said arm may press the chain tooth under the action of a spring, thus ~~and~~ realize smooth reverse; and ~~serve as a considerable a~~ certain buffering result.

[0016] The ~~said~~ reversing compensation means is a modified single-stage flywheel, in which there is a structural member for transmission between a leaf spring and a chain tooth; The leaf spring props up supports the rear end of a jack to make it elastically contact firstly with the front of ~~ladder type trapezoid-shape~~ rackets and then indirectly with the front surface of the chain tooth of an outer hull of the flywheel indirectly.

[0017] The tractive linear reciprocating driving apparatus of this invention has the following ~~vigorous positive~~ effects.:

[0018] 1. Since it adopts a single endless chain structure, the driving apparatus of ~~this~~ the present invention has a more compact structure and ~~more convenience is~~ convenient in processing-manufacturing and installation. In application, the whole apparatus can be installed directly in combination with the driving wheel ~~and or an~~ axle of a vehicle or a boat. Linearly applying of force ~~has produces~~ higher efficiency. Even if ~~adding secondary chain drive~~ an additional level of chain transmission is added, the effect is ~~also still~~ quite good.;

[0019] 2. This driving apparatus is used mainly for equipping the exercising

apparatus, ~~giving prominence due~~ to the feature of the convenient and natural method of applying force. ~~Since~~ By simultaneously pedaling stepping with his foot and pulling with his hand in operation, a user can obtain a comprehensive ~~exercising~~ exercise effect ~~can be obtained~~. It is applicable to a one-man, two-man or multi-man manually-powered vehicle ~~and-or~~ boat, as well as ~~communication-transportation~~ means or for use in sports competition.;

[0020] 3. ~~Since slipping module~~ the sliding assembly can suit adapt to the change of different angles of force applied ~~hereto, more designing space thereto~~, it provides more room for design to meet different seating postures ~~can be obtained to~~ requirements and satisfy various needs in ~~developing applications-application fields~~ and products diversification.;

[0021] 4. ~~Since it-the~~ the present apparatus is more suitable for installing in ~~securely sustained-a~~ stably supported vehicle or boat, ~~this apparatus-it~~ has the features of convenience, safety and comfort. It can be operated ~~even-by~~ a user in chair and thus suitable for the old, weak and disabled for relaxation and entertainment.

Brief Description of Drawings**BRIEF DESCRIPTION OF THE DRAWINGS**

[0022] Fig. 1 is a structural diagram of ~~this-the~~ the present invention.

[0023] Fig. 2 is a top plan view of the cross section along ~~structure delineated by~~ line A-A.

[0024] Fig. 3 is a structural diagram of the swing ~~toothed bar for chain engagement~~chain-gripping tooth plate.

[0025] Fig. 4 is a structural diagram of a reversing compensation means.

[0026] Fig. 5 is a structural diagram of ~~-directly moved toothed bar for chain engagement~~a linear moving chain-gripping tooth plate.

[0027] Fig. 6 is a structural ~~view-diagram~~ of another type of ~~-slipping apparatus~~sliding assembly.

[0028] Fig. 7 is a structural diagram of reversing compensation means integrated with ~~follower wheel~~ a driven sprocket.

[0029] Fig. 8 is a structural schematic diagram of one-man driving tricycle ~~in-of~~ a the

first embodiment.

[0030] Fig. 9 is a top plan view of the embodiment in Fig. 8.

[0031] Fig. 10 is a structural diagram of two-man driving tricycle ~~in of a~~ the second embodiment.

5 **[0032]** Fig. 11 is a structural diagram of amphibian bicycle ~~in of a~~ the third embodiment.

[0033] In the above-mentioned drawings, the following reference numbers represent:

1. main frame 2. flywheel 3. chain 4. ~~slipping module~~ sliding assembly 5. pedal
6. ~~handpower~~ hand-pulling rod 7. guide column 8. driven sprocket 9. sprocket
10 support 10. ~~reversing-compensator~~ compensation means 11. auxiliary frame pillar
11A. guide tongue 12. upper slide bar of ~~slipping module~~ the sliding assembly 13.
pull-up rod 14. ~~chain-engagement means~~ chain-gripping box 15. slave
chain-gripping engaging and reversing ~~mechanics~~ mechanism 16. slave upper slide
bar 17. chain-retaining board 18. slave lower slide bar 19. ~~chain-engaging~~
15 ~~toothed bar~~ chain-gripping tooth plate 20. lower slide bar of ~~slipping module~~ the
sliding assembly 21. pull-down rod 22. nose of connecting rod 23. front butt
plate of ~~slipping module~~ the sliding assembly 24. rear butt plate of slipping module
25. transitional coupling plate 26. bottom plate of ~~chain-engagement means~~
chain-gripping box 27. short shaft 28. hole to connect rod nose 29.
20 ~~chain-engaging~~ chain-gripping teeth 30. limit pin 31. chain-engaging teeth 32.
hanging ~~hanged~~ plate 33. groove frame 34. positioning hole 35. tension spring
36. strong compressed spring 37. arm 38. arm shaft 39. damp spring leaf 40.
guide groove 41. jogger 42. guide rail of plate column form 43. chute 44. chain
tooth 45. leaf spring 46. chute wall 47. compensation clearance 48. mobile
25 ~~erown~~ top block 49. jack spring 50. jack 51. ~~ladder type~~ trapezoid-shape
ratchet 52. ~~steel ball~~ bead 53. seat 54. ~~carriage~~ vehicle frame 55. regulating
wheel 56. foot-controlled rudder ~~mass~~ pole 57. driving wheel 58. follower
wheel 59. ~~handlebar~~ handle bar 60. rod handle 61. connecting rod 62. main
(rear) buoy 63. side buoy 64. front buoy 65. ~~impeller~~ propeller

Detailed Description of the Preferred Embodiment**DETAILED DESCRIPTION**
OF THE PREFERRED EMBODIMENT

[0034] A better understanding of the invention will be obtained by referring to the accompanying drawings ~~in which:~~.

5 **[0035]** Fig. 1 illustrates a tractive linear reciprocating driving apparatus ~~of given by~~ this invention. It comprises a main frame 1 that consists of, a guide column 7, an auxiliary frame 11 and frame endplates. Connected to one end of the main frame is a flywheel 2 with driving sprocket and to ~~the other~~ ~~another~~ end is a slave sprocket 8 with the same diameter, with a single endless chain installed in between, ~~its~~. The
10 guide column and the auxiliary frame column are installed on the side of the chain ring plane (backwards in the figure); a slipping module. A sliding assembly 4 and a slave ~~engaging chain-gripping~~ and reversing ~~mechanics-mechanism~~ 15 are installed on the guide column; The main frame may be installed in different ways for the different applications, and can be installed in the appropriate position of a vehicle or a
15 boat through connecting pieces. In this embodiment, the upper and lower slide bars 12, 20 of the ~~slipping module-sliding assembly~~ are mounted on the guide column 7 to slide upwards and downwards along the guide column with a guide tongue 11A; ~~pedal~~ Pedal 5 and ~~handpower~~ ~~hand-pulling~~ rod 6 are affixed to rear butt plate of ~~slipping module-the sliding assembly~~ so as to apply force with foot and hand; respectively. ~~The-the~~ chain ~~engagement means~~ gripping box 14 in said slave ~~engaging chain-gripping~~ and reversing ~~mechanics-mechanism~~ operates ~~works~~ in the plane of the chain ring; The chain-gripping box engagement means-14 is connected with the upper and lower slave slide bars 16, 18 and mounted together on the guide column 7. ~~In the~~ The chain-gripping box engagement means-14 is provided with a
25 chain-gripping tooth plate engaging toothed bar 19 that is float-connected by a pull-up rod, a pull-down rod, a nose of a connecting rod and ~~slipping module,~~ to the sliding assembly. The plate follows up the upward or downward movement of slipping module-the sliding assembly and controls the activity of chain-engaging chain-gripping.
In the figure, flywheel 2 -- the driving sprocket to output power, turns the force
30 applied thereto in linear way to shaft torque to operate the driving wheel.

~~Chain-retaining~~The chain-retaining board 17 with an arc projection to retain the chain is used to limit the position of chain in reversing and guarantee said chain-gripping tooth to engage chain smoothly. Reversing compensation means 10 guarantees the smooth operation of the slave ~~engaging-chain-gripping~~ and reversing-mechanics mechanism. As shown in the figure, a chain-tensioning device is provided on the sprocket support 9 to adjust the tensioning of the chain by drawing slave sprocket shaft; ~~existing.~~ The conventional structure of a bicycle chain tensioning device is adopted for this embodiment.

[0036] Fig. 2 illustrates a diagrammatic top view of this invention. Underneath is a bottom plate of the main frame 1, the guide column 7 and the auxiliary frame pillar 11 stand on both sides; ~~pedal.~~ Pedal 5 is on the left and connecting the front butt plate of ~~slipping module~~the sliding assembly 23, 24 and the lower slide bar 20;. The chain-gripping box engagement means 14 is shown in cross sectional view comprising chain-gripping tooth plate ~~engaging toothed bar~~ 19, the pull-down rod 21 and a flywheel hidden underneath. ~~Chain~~ The chain-gripping box engagement means 14 connects the upper and lower slave slide bars with transitional coupling plate 25. As shown in the figure, a slave lower slide bar 18 and a lower slide bar of the ~~slipping module~~sliding assembly 20 matches with the jaw at a guide tongue 11A on the right. The relation of connection between lower slide bar 20 and two butt plates 23, 24 of ~~slipping module~~the sliding assembly incorporating ~~handpower~~a hand-pulling rod 6 and a pedal 5 is clearly shown ~~manifestly~~.

[0037] Fig. 3 illustrates the structure of the chain-gripping assembly ~~engaging module~~ in said chain-gripping box ~~engagement means~~ 14. It belongs to a swing chain-gripping ~~engaging~~ mechanism. ~~Chain~~ A chain-gripping tooth plate ~~engaging toothed bar~~ 19 is fixed on a bottom plate 26 by a short shaft 27 with a hole 28 to connect the rod nose; ~~when.~~ When the tooth plate being drawn upwards and downwards, it swings and reverses the ~~chain to engaged~~direction. There are two chain-gripping ~~engaging~~ teeth 29, 31 towards ~~both~~ two opposite directions on said chain-gripping tooth plate ~~engaging toothed bar~~ 19, ~~together with.~~ The tooth plate and the chain-retaining board 17 with a chain-retaining arc projection, ~~jointly match~~

cooperate with chain 3 and ~~are activate~~ alternately ~~activated~~ to perform automatic slave reversing. There 30-is a limit pin 30.

[0038] The course of slave reversing control is as follows: when the nose of the connecting rod 22 is drawn downwards, the chain-gripping engaging-teeth 31 will insert in chain-links on the left to carry said chain to go downwards; when drawn upwards, the chain-engaging teeth 31 will disengage ~~said-the chain~~ and the chain-engaging teeth 29 will insert in chain on the right to carry said chain to go upwards. There 30-is a limit pin 30.

[0039] Fig. 4 illustrates the reversing compensation means installed on the lower part of the slave sprocket on the frame. The hanging hanged-plate 32 of said device is connected with a slave sprocket 8 by a coaxial coupling. An arm 37 is rotatable around the arm axle 38 in the hanging hanged-plate 32. The upper arm end makes straightforward contact with the sprocket teeth. The lower arm end connects a tension spring 35, enabling the upper arm end to contact the front surface of the sprocket tooth front-directly and always activate-engage said tooth-frontsurface. In reversing of direction, when ~~lower engaging toothed bar~~ the chain-gripping tooth plate 19 below moves towards opposite side, a compensation motion in opposite direction occurs to solve the problem that ~~toothed bar-the chain-gripping teeth~~ cannot be inserted in the chain link hole for an instant, and ensures smooth reversing. A strong Strong-compressed spring 36 acts as a buffer in the course of reversing direction. 38 is an arm axle for securing the arm. A positioning Positioning-hole 34 is used for adjusting mounting position. 39 is a damp spring leaf. 33 is a fixed groove frame-for securing.

[0040] Fig. 5 illustrates another embodiment of the chain-gripping tooth plate engaging toothed bar with linear directly-motion structure. The chain-gripping tooth plate reverses its direction by moving in the Chain-engaging toothed bar reverses in guide groove 40. In addition, and-joggers 41 are added.

[0041] Fig. 6 illustrates another embodiment of the guide column structure wherein 4 is the sliding assembly slipping module and the slave chain-gripping-engaging and reversing mechanism is mechanics-are also located therein. 42 is a guide rail of plate column form and 43 is a chute.

5 [0042] Fig. 7 illustrates a reverse compensation means modified from a single-stage flywheel of a conventional existing bicycle. It can function as a ~~has dual functions of~~ slave sprocket or a ~~and~~ flywheel. The figure shows a part of the flywheel case in which 44 is a chain tooth in the the outskirt of the outer hull that incorporates the trapezoid shape ~~ladder type~~ ratchets 51 in the inner margin of said outer hull 4. A ~~bead, ball~~ path with steel ~~beads~~ balls installed therein is located on both sides of said ratchets; ~~a~~ A jack 50 (or chaplet) ~~supports props up~~ the inner side ~~inside~~ of said ratchet to force the outer hull only to be in unidirectional rotation. A ~~jack~~ Jack-spring 49 (or chaplet spring) forces said jack to prop up and always be in a working condition.

10 A ~~flywheel~~ Flywheel-base and a bottom cover plate form an inner hull installed on the drive shaft. Originally, the flywheel ~~Flywheel originally~~ performs only pure circular motion. There is no ~~and needs no~~ reversing or compensation problem. To adapt to the reversing function in ~~for~~ this tractive linear reciprocating driving apparatus, a mobile top block ~~erown~~ 48 is added in a jack groove of the inner hull, which is

15 between the original jack and the fixed block to support the bear said jack, leaving an appropriate clearance (length) 47 for reversing compensation. 46 is the chute wall. A leaf spring 45 is provided behind said mobile top block. ~~erown~~, The leaf spring bends ~~bending~~ when said jack ~~presses props up~~ said ratchet. When in use, the ~~This~~ compensator ~~uses solid inner hull is fixed~~. During reversing, the leaf spring thereof

20 rebounds and presses props up said jack to provide a compensation shift in the opposite direction and in reversing, carries out the insertion of the teeth of the chain-gripping tooth plate ~~toothed bar~~ into the chain hole during said shift so as to avoid instant failing of insertion and guarantee a smooth reversing.

25 [0043] Figs. 8, 9, 10 and 11 are embodiments of three different applications of this invention.

30 [0044] Figs. 8 and 9 illustrate structure of a ~~the same~~ one-man manually-powered tricycle that comprises a carriage 54, a regulating wheel 55, a driving wheel 57, a follower wheel 58, a pedal 5, a seat 53, handlebar, as well as the transmission and brake devices. The conventional ~~Traditional~~ mechanism is used for its brake device.

The driving ~~Driving~~ wheel is in the right-front to the right; The regulating wheel is in the back ~~behind~~, ~~and~~ The driving apparatus is installed on the carriage in front of ~~before~~ the seat. Connected to driving apparatus 1 are the pedal, rod handles 60, handle

bar 59 and a foot-controlled rudder pole mass-56 with ~~double-foot~~ positions for two feet. In this embodiment, both hands and feet can be used simultaneously, with one foot controlling direction. On the basis of this embodiment, a two-man manually-powered tricycle can be ~~simply-developed~~ simply by widening the carriage and the seat. A conventional Traditional brake can also be used.

[0045] The following ~~Hereunder~~ explains the working procedure of the tractive linear reciprocating driving apparatus of this invention as shown in the embodiment of said one-man tricycle.;

[0046] 1. After ~~riding on seat~~ seated, a user controls regulating wheel with one foot, pedals ~~step~~ with the other foot, grips the rod handle with one hand to be ready for lifting and holds the handle bar with the other hand.

[0047] 2. When pedaling by the user ~~stepping~~, the sliding assembly ~~slipping module-4~~ goes ~~directly downwards along a straight line, through the driven by-nose of the~~ connecting rod 22, drives the pull-down rod 21 to enable ~~enables the~~ chain-gripping engaging-teeth 31 of the chain-gripping tooth plate ~~engaging toothed bar-19~~ to insert into the left chain. ; ~~while~~ By continuously applying force by the user, the flywheel 2 operates runs and the driving wheel rotates to drive the tricycle forwards (to the left in the figure).;

[0048] 3. When lifting the rod with hand by the user, the sliding assembly ~~slipping module-4~~ goes ~~directly upwards along a straight line and through;~~ the pull-up rod 13 is driven to enables chain-gripping engaging-teeth 29 of the chain-gripping tooth plate engaging toothed bar 19 to insert in the right chain. By ; ~~while~~ continuously applying force by the user, flywheel 2 rotates runs in original direction and the driving wheel rotates to drive the tricycle forwards (to the left in the figure).;

[0049] 4. When stopping applying force by the user during pedaling ~~in stepping~~ with his/her foot and lifting with his/her hand, the tricycle keeps running forward by inertia.;

[0050] 5. Repeat above-said operation of stepping with the foot and lifting with the hand, the tricycle keeps running forward.

[0051] Fig. 10 illustrates an embodiment a of another kind of fore-and-aft two-man tricycle. The regulating ~~Regulating~~ wheel 55 is located on ~~designed in the~~ left front. The, driving wheel 57 is on the right side in the middle. The, follower rear wheel

58 is provided on the left side of the rear seat, ~~namely~~In another word, the front and rear wheels are on the one same-side and the driving wheel in the middle is on the other side. Two fore-and-aft seats are ~~provided~~designed. The front seat rider controls the direction and pedals joins stepping with his foot, ~~thus the~~; connecting rod 61
5 transmits the imparts-driving power to the sliding assemblyslipping module. The rear seat rider mainly pulls the rod 60 to apply force. Two riders alternately apply force to jointly drive the tricycle forward. If necessary, the rear seat rider may can-help in applying force with pedalingstepping. In fact, various two-man embodiments may be designed by utilizing the driving apparatus of this invention, for example, such as the
10 design with type of-rear regulating wheel, the design with double driving apparatus and two-man seats facing in-the same direction, the design face-to-face type with a single or double driving apparatus and two-man seats facing opposite direction, and the design 4-wheel type with single or double driving apparatus having 4 parrallel wheels.

15 **[0052]** Fig. 11 illustrates a structural representation of an amphibious bicycle that incorporates a carriage 54 and wheels, with the driving apparatus 1 tilting in the frontforwards. To suit application in water, an-a propeller impeller-65 driven by a chain drive is positioned on the designed-in upper front. The propeller 65 has with-a draft of 1/4~1/6 of the propeller impeller-diameter. Three pairs of buoys are set in the
20 front, middle and rear parts of the carriage on the left and right sides. They are the respectively-front buoys 64, side buoys 63 and main (rear) buoys 62, respectively. The side Side-buoys 63 are fixed on both sides of carriage with the supporting litter that incorporate hinges to retract buoys. The buoys at position B, C and D are omitted on in-one side in the figure.

25 **[0053]** As indicated abioveTo sum-up, many products with different structures can be developed utilizing the driving apparatus of this invention. Such arrangements also include: adding an additional secondary-chain drive, utilizing leverage or hydraulic transmission, using multiple driving apparatus and different seating postures. Since there may be many varieties, this invention has an excellent future in practical of
30 application. †

What is claimed is:

1. ~~A tractive~~ Tractive-linear reciprocating driving apparatus having slipping module (4), slave engaging and reversing mechanics (15), slave sprocket (8), chain (3), guide column (7), in combination, comprising:

5 a A-frame (1) of the driving apparatus mainly composed of a by-guide column (7), an auxiliary frame pillar (11) and frame end plates, two opposite both ends of the frame (1) each equipped with a flywheel (2) and a slave sprocket, respectively (8), with a single endless chain operatively connected therebetween to form a chain ring (3) installed in between, the guide column (7) used for unidirectional linear sliding
10 slipping and the auxiliary frame pillar (11) installed positioned on a plane that is parallel to the endless both sides of chain ring plane; and

a sliding assembly slipping module (4) used for driving and a slave chain-engaging and reversing mechanism mechanics (15) thereof mounted on the guide column, (7);

15 the sliding assembly having Said slipping module (4) has upper and lower slide bars (12, 20) of slipping module mounted on the said guide column for 7-sliding upwards and downwards along the guide column, at least one pedal (5) and at least one hand-controlled handpower rod (6) used for propulsion mounted on an outside butt plate of the sliding assemblyslipping module (4);

20 wherein:

1) a chain engagement means of said slave chain-engaging and reversing mechanism mechanics (15) is positioned in the endless chain ring plane of chain ring, chain engagement means being 14 is connected with upper and lower slave slide bars that are mounted (16, 18) and mounted together on the guide column-7, a chain
25 engaging tooth plate being provided in the chain engagement means and one end of the chain engaging tooth plane being is provided a chain engaging toothed bar, the strained end thereof is float-connected with the sliding assembly via slipping module and connecting pieces including that consist of a pull-up rod (13), a pull-down rod (21) and a nose of a connecting rod (22); there are two chain-engaging teeth on the chain
30 engaging tooth plate tilted (29, 31) towards two opposite both directions and alternatively engaging the endless chain on said chain-engaging toothed bar (19), in cooperation together with a chain-retaining board having a (17) with chain-retaining arc projection, jointly match with chain 3 and are alternately activated to work;

2) Aa reversing compensation means (10) used with the slave chain-engaging and
35 reversing mechanism has mechanics having a resilient member that can contact a the

front surface of a chain tooth on the flywheel or the slave sprocket directly or indirectly in inverse direction, and a space or clearance is reserved left for movement.

2. The tractive ~~Traction~~-linear reciprocating driving apparatus according to claim
5 1, wherein said reversing compensation means is a resilient contact mobile member
mechanics-mounted on or beneath the slave sprocket-(8), the and an arm-(37) under
the force of the resilient contact mobile member elastically contacts the front surface
of a chain tooth of the slave sprocket-(8).

10 3. The tractive ~~Traction~~-linear reciprocating driving apparatus according to claim
1, wherein said reversing compensation means is a modified single-stage flywheel in
which there is a structural member for transmission of force between a leaf spring-(45)
and a chain tooth of the flywheel, the leaf spring pressing a props up the rear end of a
jack located near an inner periphery of the flywheel to make it the jack firstly
15 elastically contact a first the front surface of trapezoid shape ladder-type rackets on the
inner periphery of the flywheel and then indirectly contact the front surface of a chain
tooth on an of outer hull indirectly of the flywheel.

4. A tractive linear reciprocating driving apparatus comprising:
20 a frame of the driving apparatus composed of a guide column in parallel with
an auxiliary frame pillar, and two parallel frame end plates in perpendicular position
connecting both ends of the guide column and the auxiliary frame pillar to form a
generally rectangular shape, two opposite ends of frame each equipped with a
flywheel and a slave sprocket, respectively, with a single endless chain operatively
25 connected therebetween to form a chain ring, the guide column used for unidirectional
linear sliding and the auxiliary frame pillar positioned on a plane that is parallel to the
endless chain ring plane; and

a sliding assembly used for driving and a slave chain-engaging and reversing
mechanism thereof mounted on the guide column,
30 the sliding assembly having upper and lower slide bars mounted on the guide
column for sliding along the guide column, at least one pedal and at least one
hand-controlled rod used for propulsion mounted on an outside butt plate of the
sliding assembly;

wherein:

a chain engagement means of said slave chain-engaging and reversing mechanism is positioned in the endless chain ring plane, chain engagement means being connected with upper and lower slave slide bars that are mounted on the guide column, a chain engaging tooth plate being provided in the chain engagement means and one end of the chain engaging tooth plane being is float-connected with the sliding assembly via connecting pieces including a pull-up rod, a pull-down rod and a nose of a connecting rod; two chain-engaging teeth on the chain engaging tooth plate tilted towards two opposite directions and alternatively engaging the endless chain in cooperation with a chain-retaining board having a chain-retaining arc projection;

a reversing compensation means used with the slave chain-engaging and reversing mechanism has a resilient member that can contact a front surface of a chain tooth on the flywheel or the slave sprocket directly or indirectly in inverse direction, and a space or clearance is reserved for movement.

ABSTRACT

ABSTRACT OF THE DISCLOSURE

The present invention relates to a linear reciprocating driving apparatus. It includes a
5 sliding assembly~~slipping—module~~, a slave chain-engaging and reversing
mechanism~~mechanics~~, a flying wheel, a driven sprocket, a driving chain, and a guide
column. The sliding assembly ~~slipping—module~~ is arranged on the framework of the
propulsion apparatus to be activated by a rider. Also there is provided a slave
chain-engaging and reversing mechanics with compensation means. The propulsion
10 apparatus can obtain satisfying results and high efficiency. The invention can be
applied to various manually powered vehicle and watercraft. They are mainly used for
communication to substitute walking and physical exercise.